Supplementary Table S1 - Author Contributions			Developed BioPAX:			
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Supplementary Table S2. An example BioPAX file describing the phosphorylation and activation of CHK2 by ATM in human. Data was originally obtained from the Reactome database[8].

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            <bp:entityReference rdf:resource="#CHK2"/>
            <bp:name rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
            >CHEK2</bp:name>
            <bp:xref rdf:resource="#UnificationXref_12"/>
            <bp:feature>
              <bp:ModificationFeature rdf:ID="ModificationFeature_17">
                <bp:featureLocation rdf:resource="#SequenceSite_20"/>
                <bp:modificationType>
                  <bp:SequenceModificationVocabulary
rdf:ID="SequenceModificationVocabulary_18">
                    <bp:xref>
                      <bp:UnificationXref rdf:ID="UnificationXref_19">
                        <bp:db rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
                        >PSI-MI</bp:db>
                        <bp:id rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
                        >MI:0176</bp:id>
                      </bp:UnificationXref>
                    </bp:xref>
                    <bp:term rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
                    >o-phospho-serine</bp:term>
                  </bp:SequenceModificationVocabulary>
                </bp:modificationType>
              </bp:ModificationFeature>
            </bp:feature>
            <bp:standardName rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
            >Serine/threonine-protein kinase Chk2 (Cds1)</bp:standardName>
            <bp:dataSource rdf:resource="#Provenance_3"/>
            <bp:displayName rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
            >CHK2</bp:displayName>
            <bp:cellularLocation rdf:resource="#CellularLocationVocabulary_6"/>
          </bp:Protein>
        </bp:right>
        <bp:xref rdf:resource="#PublicationXref_24"/>
        <bp:right rdf:resource="#SmallMolecule_21"/>
        <bp:participantStoichiometry>
          <bp:Stoichiometry rdf:ID="Stoichiometry_2">
            <bp:stoichiometricCoefficient
rdf:datatype="http://www.w3.org/2001/XMLSchema#float"
            >1.0</bp:stoichiometricCoefficient>
            <bp:physicalEntity>
              <bp:Protein rdf:ID="Protein_27">
                <bp:dataSource rdf:resource="#Provenance_3"/>
                <bp:entityReference rdf:resource="#ATM"/>
                <bp:name rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
                >Ataxia telangiectasia mutated) (A-T, mutated) </bp:name>
                <bp:standardName
rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
                >Serine-protein kinase AT(Ataxia telangiectasia mutated) (A-T,
mutated)</bp:standardName>
                <bp:cellularLocation rdf:resource="#CellularLocationVocabulary_6"/>
                <bp:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
                >"FUNCTION Involved in signal transduction, cell cycle control and DNA
repair. May function as a tumor suppressor. Necessary for activation of ABL1 and
SAPK"</bp:comment>
                <bp:xref rdf:resource="#UnificationXref_28"/>
                <bp:displayName rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
                >ATM</bp:displayName>
              </bp:Protein>
            </bp:physicalEntity>
          </bp:Stoichiometry>
        </bp:participantStoichiometry>
        <bp:left rdf:resource="#Protein_5"/>
        <bp:left>
          <bp:SmallMolecule rdf:ID="SmallMolecule_13">
            <bp:entityReference>
              <bp:SmallMoleculeReference rdf:ID="SmallMoleculeReference_15">
                <bp:displayName rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
                >ATP</bp:displayName>
                <bp:xref>
                  <bp:UnificationXref rdf:ID="UnificationXref_14">
```

```
                    <bp:id rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
                    >CHEBI:2359</bp:id>
                    <bp:db rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
                    >ChEBI</bp:db>
                  </bp:UnificationXref>
                </bp:xref>
                <bp:standardName
rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
                  >Adenosine 5'-triphosphate</bp:standardName>
              </bp:SmallMoleculeReference>
            </bp:entityReference>
            <bp:xref rdf:resource="#UnificationXref_14"/>
            <bp:cellularLocation rdf:resource="#CellularLocationVocabulary_6"/>
            <bp:standardName rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
            >Adenosine 5'-triphosphate</bp:standardName>
            <bp:dataSource rdf:resource="#Provenance_3"/>
            <bp:displayName rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
            >ATP</bp:displayName>
          </bp:SmallMolecule>
        </bp:left>
        <bp:participantStoichiometry>
          <bp:Stoichiometry rdf:ID="Stoichiometry_1">
            <bp:physicalEntity rdf:resource="#Protein_5"/>
            <bp:stoichiometricCoefficient
rdf:datatype="http://www.w3.org/2001/XMLSchema#float"
            >1.0</bp:stoichiometricCoefficient>
          </bp:Stoichiometry>
        </bp:participantStoichiometry>
        <bp:xref>
          <bp:UnificationXref rdf:ID="UnificationXref_26">
            <bp:id rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
            >REACT_69891</bp:id>
            <bp:db rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
            >reactome</bp:db>
            <bp:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
            >http://www.reactome.org </bp:comment>
          </bp:UnificationXref>
        </bp:xref>
        <bp:displayName rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
        >Phosphorylation and activation of CHK2 by ATM</bp:displayName>
        <bp:conversionDirection rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
        >LEFT-TO-RIGHT</bp:conversionDirection>
        <bp:dataSource rdf:resource="#Provenance_3"/>
        <bp:participantStoichiometry>
          <bp:Stoichiometry rdf:ID="Stoichiometry_4">
            <bp:stoichiometricCoefficient
rdf:datatype="http://www.w3.org/2001/XMLSchema#float"
            >1.0</bp:stoichiometricCoefficient>
            <bp:physicalEntity rdf:resource="#SmallMolecule_13"/>
          </bp:Stoichiometry>
        </bp:participantStoichiometry>
        <bp:xref>
          <bp:PublicationXref rdf:ID="PublicationXref_25">
            <bp:author rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
            >McGowan, CH </bp:author>
            <bp:author rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
            >Laus, MC </bp:author>
            <bp:author rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
            >Luyten, WH </bp:author>
            <bp:title rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
            >A human homologue of the checkpoint kinase Cds1 directly inhibits Cdc25
phosphatase.</bp:title>
            <bp:source rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
            >Curr Biol 9:1-10 </bp:source>
            <bp:author rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
            >Parker, AE </bp:author>
            <bp:author rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
            >de Weyer, IV </bp:author>
            <bp:author rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
            >Blasina, A </bp:author>
            <bp:id rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
            >9889122</bp:id>
```

```
            <bp:db rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
            >pubmed</bp:db>
            <bp:year rdf:datatype="http://www.w3.org/2001/XMLSchema#int"
            >1999</bp:year>
          </bp:PublicationXref>
        </bp:xref>
        <bp:participantStoichiometry>
          <bp:Stoichiometry rdf:ID="Stoichiometry_3">
            <bp:physicalEntity rdf:resource="#SmallMolecule_21"/>
            <bp:stoichiometricCoefficient
rdf:datatype="http://www.w3.org/2001/XMLSchema#float"
            >1.0</bp:stoichiometricCoefficient>
          </bp:Stoichiometry>
        </bp:participantStoichiometry>
        <bp:spontaneous rdf:datatype="http://www.w3.org/2001/XMLSchema#boolean"
        >false</bp:spontaneous>
      </bp:BiochemicalReaction>
    </bp:controlled>
    <bp:controlType rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >ACTIVATION</bp:controlType>
    <bp:controller rdf:resource="#Protein_27"/>
    <bp:displayName rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >ATM phosphorylates and activates CHK2</bp:displayName>
    <bp:xref rdf:resource="#RelationshipXref_29"/>
    <bp:availability rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >Reactome is a free on-line resource, and Reactome software is open-source.
However, please take note of our disclaimer. (http://reactome.org/disclaimer.html)
</bp:availability>
    <bp:catalysisDirection rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >LEFT-TO-RIGHT</bp:catalysisDirection>
  </bp:Catalysis>
</rdf:RDF>

<!-- Created with Protege (with OWL Plugin 3.3.1, Build 430)
http://protege.stanford.edu -->
```

Supplementary Table S3. An example BioPAX file describing the two reactions involved in glucose metabolism in *Escherichia coli*. Data was originally obtained from the EcoCyc database[14].

```
<?xml version="1.0"?>
<rdf:RDF
    xmlns="http://www.biopax.org/examples/myExample#"
    xmlns:bp="http://www.biopax.org/release/biopax-level3.owl#"
    xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
    xmlns:xsd="http://www.w3.org/2001/XMLSchema#"
    xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
    xmlns:owl="http://www.w3.org/2002/07/owl#"
    xmlns:p1="http://www.owl-ontologies.com/assert.owl#"
  xml:base="http://www.biopax.org/examples/myExample">
  <owl:Ontology rdf:about="">
    <owl:imports rdf:resource="http://www.biopax.org/release/biopax-level3.owl"/>
  </owl:Ontology>
  <bp:Protein rdf:ID="Protein_54">
    <bp:standardName rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >GLK</bp:standardName>
    <bp:displayName rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >glucokinase</bp:displayName>
    <bp:xref>
      <bp:UnificationXref rdf:ID="SwissProtTrEMBL_P46880">
        <bp:id rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
        >P46880</bp:id>
        <bp:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
        >PMID: 15608167</bp:comment>
        <bp:db rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
        >uniprot</bp:db>
      </bp:UnificationXref>
    </bp:xref>
    <bp:entityReference>
      <bp:ProteinReference rdf:ID="ProteinReference_15">
        <bp:sequence rdf:datatype="http://www.w3.org/2001/XMLSchema#string"

>MTKYALVGDVGGTNARLALCDIASGEISQAKTYSGLDYPSLEAVIRVYLEEHKVEVKDGCIAIACPITGDWVAMTNHTWAFSIAE
MKKNLGFSHLEIINDFTAVSMAIPMLKKEHLIQFGGAEPVEGKPIAVYGAGTGLGVAHLVHVDKRWVSLPGEGGHVDFAPNSEEEA
IILEILRAEIGHVSAERVLSGPGLVNLYRAIVKADNRLPENLKPKDITERALADSCTDCRRALSLFCVIMGRFGGNLALNLGTFGG
VFIAGGIVPRFLEFFKASGFRAAFEDKGRFKEYVHDIPVYLIVHDNPGLLGSGAHLRQTLGHIL</bp:sequence>
        <bp:xref rdf:resource="#SwissProtTrEMBL_P46880"/>
        <bp:name rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
        >glucose kinase</bp:name>
        <bp:displayName rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
        >glucokinase</bp:displayName>
        <bp:standardName rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
        >GLK</bp:standardName>
        <bp:organism>
          <bp:BioSource rdf:ID="Escherichia_coli">
            <bp:taxonXref>
              <bp:UnificationXref rdf:ID="taxon_562">
                <bp:id rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
                >562</bp:id>
                <bp:db rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
                >taxonomy</bp:db>
              </bp:UnificationXref>
            </bp:taxonXref>
            <bp:displayName rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
            >Escherichia coli</bp:displayName>
          </bp:BioSource>
        </bp:organism>
      </bp:ProteinReference>
    </bp:entityReference>
    <bp:name rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >GLK_ECOLI</bp:name>
    <bp:cellularLocation>
      <bp:CellularLocationVocabulary rdf:ID="cytoplasm">
        <bp:xref>
          <bp:UnificationXref rdf:ID="GO_0005737">
```

```
            <bp:id rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
            >GO:0005737</bp:id>
            <bp:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
            >PMID: 11483584 </bp:comment>
            <bp:db rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
            >Gene Ontology</bp:db>
          </bp:UnificationXref>
        </bp:xref>
        <bp:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
        >This example is meant to provide an illustration of how various BioPAX slots
should be filled; it is not intended to provide useful (or even accurate) biological
information  </bp:comment>
        <bp:term rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
        >cytoplasm</bp:term>
      </bp:CellularLocationVocabulary>
    </bp:cellularLocation>
    <bp:dataSource>
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        <bp:displayName rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
        >Swiss-Prot/TrEMBL</bp:displayName>
      </bp:Provenance>
    </bp:dataSource>
    <bp:dataSource>
      <bp:Provenance rdf:ID="aMAZE">
        <bp:displayName rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
        >aMAZE</bp:displayName>
        <bp:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
        ></bp:comment>
      </bp:Provenance>
    </bp:dataSource>
  </bp:Protein>
  <bp:ChemicalStructure rdf:ID="ChemicalStructure_9">
    <bp:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    ></bp:comment>
    <bp:structureFormat rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >SMILES</bp:structureFormat>
    <bp:structureData rdf:datatype="http://www.w3.org/2001/XMLSchema#string"

>[CH]3(n1(c2(c(nc1)c(N)ncn2)))(O[CH]([CH](O)[CH](O)3)COP(=O)(O)OP(O)(=O)OP(O)(=O)O)</b
p:structureData>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >ATP</rdfs:comment>
  </bp:ChemicalStructure>
  <bp:Stoichiometry rdf:ID="Stoichiometry_52">
    <bp:stoichiometricCoefficient
rdf:datatype="http://www.w3.org/2001/XMLSchema#float"
    >1.0</bp:stoichiometricCoefficient>
    <bp:physicalEntity>
      <bp:SmallMolecule rdf:ID="alpha-D-glucose_6-phosphate">
        <bp:dataSource rdf:resource="#aMAZE"/>
        <bp:xref>
          <bp:UnificationXref rdf:ID="KEGG_C00668">
            <bp:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
            >PMID: 9847135</bp:comment>
            <bp:id rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
            >C00668</bp:id>
            <bp:db rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
            >KEGG compound</bp:db>
          </bp:UnificationXref>
        </bp:xref>
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        >b-D-glucose-6-phoshate</bp:name>
        <bp:name rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
        >glucose-6-P</bp:name>
        <bp:displayName rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
        >beta-D-glucose 6-phosphate</bp:displayName>
        <bp:entityReference>
          <bp:SmallMoleculeReference rdf:ID="SmallMoleculeReference_13">
            <bp:molecularWeight rdf:datatype="http://www.w3.org/2001/XMLSchema#float"
            >260.14</bp:molecularWeight>
            <bp:chemicalFormula rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
            >C6H13O9P</bp:chemicalFormula>
```

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            <bp:structure>
              <bp:ChemicalStructure rdf:ID="ChemicalStructure_7">
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                <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
                >beta-glucose-6-phosphate</rdfs:comment>
                <bp:structureFormat
rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
                >SMILES</bp:structureFormat>
              </bp:ChemicalStructure>
            </bp:structure>
            <bp:displayName rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
            >beta-D-glucose 6-phosphate</bp:displayName>
            <bp:standardName rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
            >b-D-glu-6-p</bp:standardName>
            <bp:xref rdf:resource="#KEGG_C00668"/>
          </bp:SmallMoleculeReference>
        </bp:entityReference>
        <bp:name rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
        >D-glucose-6-P</bp:name>
        <bp:cellularLocation rdf:resource="#cytoplasm"/>
        <bp:dataSource>
          <bp:Provenance rdf:ID="KEGG">
            <bp:standardName rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
            >Kyoto Encyclopedia of Genes and Genomes</bp:standardName>
            <bp:displayName rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
            >KEGG</bp:displayName>
            <bp:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
            ></bp:comment>
          </bp:Provenance>
        </bp:dataSource>
        <bp:standardName rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
        >a-D-glu-6-p</bp:standardName>
        <bp:name rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
        >beeta-D-glucose-6-p</bp:name>
      </bp:SmallMolecule>
    </bp:physicalEntity>
  </bp:Stoichiometry>
  <bp:UnificationXref rdf:ID="KEGG_R01786">
    <bp:db rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >kegg reaction</bp:db>
    <bp:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >PMID: 9847135 </bp:comment>
    <bp:id rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >R01786</bp:id>
  </bp:UnificationXref>
  <bp:BiochemicalReaction rdf:ID="phosphoglucoisomerase">
    <bp:eCNumber rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >5.3.1.9 </bp:eCNumber>
    <bp:participantStoichiometry>
      <bp:Stoichiometry rdf:ID="Stoichiometry_57">
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rdf:datatype="http://www.w3.org/2001/XMLSchema#float"
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        <bp:physicalEntity>
          <bp:SmallMolecule rdf:ID="beta-D-fructose_6-phosphate">
            <bp:name rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
            >&lt;FONT FACE="Symbol"&gt;b&lt;/FONT&gt;-D-fructose-6-phosphate
      </bp:name>
            <bp:entityReference>
              <bp:SmallMoleculeReference rdf:ID="SmallMoleculeReference_14">
                <bp:structure>
                  <bp:ChemicalStructure rdf:ID="ChemicalStructure_8">
                    <bp:structureData
rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
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                    <rdfs:comment
rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
                    >beta-fructose-6-phosphate</rdfs:comment>
                    <bp:structureFormat
rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
```

```
                    >SMILES</bp:structureFormat>
                  </bp:ChemicalStructure>
                </bp:structure>
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                >beta-D-fructose 6-phosphate</bp:displayName>
                <bp:molecularWeight
rdf:datatype="http://www.w3.org/2001/XMLSchema#float"
                >260.14</bp:molecularWeight>
                <bp:chemicalFormula
rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
                >C6H13O9P</bp:chemicalFormula>
                <bp:standardName
rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
                >b-D-fru-6-p</bp:standardName>
                <bp:xref>
                  <bp:UnificationXref rdf:ID="KEGG_C05345">
                    <bp:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
                    >PMID: 9847135 </bp:comment>
                    <bp:id rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
                    >C05345</bp:id>
                    <bp:db rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
                    >kegg compound</bp:db>
                  </bp:UnificationXref>
                </bp:xref>
              </bp:SmallMoleculeReference>
            </bp:entityReference>
            <bp:dataSource rdf:resource="#aMAZE"/>
            <bp:dataSource rdf:resource="#KEGG"/>
            <bp:xref rdf:resource="#KEGG_C05345"/>
            <bp:standardName rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
            >b-D-fru-6-p</bp:standardName>
            <bp:displayName rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
            >beta-D-fructose 6-phosphate</bp:displayName>
            <bp:cellularLocation rdf:resource="#cytoplasm"/>
          </bp:SmallMolecule>
        </bp:physicalEntity>
      </bp:Stoichiometry>
    </bp:participantStoichiometry>
    <bp:conversionDirection rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >REVERSIBLE</bp:conversionDirection>
    <bp:displayName rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >beta-D-glu-6-p &lt;=&gt; beta-D-fru-6-p</bp:displayName>
    <bp:dataSource rdf:resource="#aMAZE"/>
    <bp:left rdf:resource="#alpha-D-glucose_6-phosphate"/>
    <bp:xref>
      <bp:UnificationXref rdf:ID="KEGG_R02740">
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        >kegg reaction</bp:db>
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        >R02740</bp:id>
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    </bp:xref>
    <bp:name rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >beta-D-Glucose 6-phosphate =&gt; beta-D-Fructose 6-phosphate</bp:name>
    <bp:dataSource rdf:resource="#KEGG"/>
    <bp:standardName rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >b-D-glu-6-p &lt;=&gt; b-D-fru-6-p</bp:standardName>
    <bp:right rdf:resource="#beta-D-fructose_6-phosphate"/>
    <bp:deltaG>
      <bp:DeltaG rdf:ID="DeltaG_12">
        <bp:deltaGPrime0 rdf:datatype="http://www.w3.org/2001/XMLSchema#float"
        >0.4</bp:deltaGPrime0>
      </bp:DeltaG>
    </bp:deltaG>
    <bp:name rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >beta-D-Glucose 6-phosphate ketol-isomerase</bp:name>
    <bp:participantStoichiometry>
      <bp:Stoichiometry rdf:ID="Stoichiometry_58">
        <bp:physicalEntity rdf:resource="#alpha-D-glucose_6-phosphate"/>
```

```
        <bp:stoichiometricCoefficient
rdf:datatype="http://www.w3.org/2001/XMLSchema#float"
        >1.0</bp:stoichiometricCoefficient>
      </bp:Stoichiometry>
    </bp:participantStoichiometry>
  </bp:BiochemicalReaction>
  <bp:SmallMoleculeReference rdf:ID="SmallMoleculeReference_10">
    <bp:structure>
      <bp:ChemicalStructure rdf:ID="ChemicalStructure_6">
        <bp:structureFormat rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
        >SMILES</bp:structureFormat>
        <bp:structureData rdf:datatype="http://www.w3.org/2001/XMLSchema#string"

>c12(n(cnc(c(N)ncn1)2)[CH]3(O[CH]([CH](O)[CH](O)3)COP(=O)(O)OP(O)(=O)O))</bp:structure
Data>
        <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
        >ADP</rdfs:comment>
      </bp:ChemicalStructure>
    </bp:structure>
    <bp:xref>
      <bp:UnificationXref rdf:ID="KEGG_C00008">
        <bp:id rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
        >C00008</bp:id>
        <bp:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
        >PMID: 9847135 </bp:comment>
        <bp:db rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
        >kegg compound</bp:db>
      </bp:UnificationXref>
    </bp:xref>
    <bp:name rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >adenosine diphosphate</bp:name>
    <bp:chemicalFormula rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >C10H15N5O10P2</bp:chemicalFormula>
    <bp:standardName rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >ADP</bp:standardName>
    <bp:molecularWeight rdf:datatype="http://www.w3.org/2001/XMLSchema#float"
    >427.2</bp:molecularWeight>
    <bp:displayName rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >Adenosine 5'-diphosphate</bp:displayName>
  </bp:SmallMoleculeReference>
  <bp:PublicationXref rdf:ID="PublicationXref49">
    <bp:id rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >2549346</bp:id>
    <bp:db rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >PubMed</bp:db>
  </bp:PublicationXref>
  <bp:UnificationXref rdf:ID="Swiss-ProtTrEMBL_Q9KH85">
    <bp:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >  PMID: 15608167</bp:comment>
    <bp:id rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >Q9KH85</bp:id>
    <bp:db rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >UniProt</bp:db>
  </bp:UnificationXref>
  <bp:SmallMoleculeReference rdf:ID="SmallMoleculeReference_11">
    <bp:structure rdf:resource="#ChemicalStructure_9"/>
    <bp:name rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >adenosine triphosphate</bp:name>
    <bp:molecularWeight rdf:datatype="http://www.w3.org/2001/XMLSchema#float"
    >507.18</bp:molecularWeight>
    <bp:chemicalFormula rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >C10H16N5O13P3</bp:chemicalFormula>
    <bp:standardName rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >ATP</bp:standardName>
    <bp:xref>
      <bp:UnificationXref rdf:ID="KEGG_C00002">
        <bp:id rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
        >C00002</bp:id>
        <bp:db rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
        >kegg compound</bp:db>
        <bp:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
        >PMID: 9847135 </bp:comment>
```

```
      </bp:UnificationXref>
    </bp:xref>
    <bp:displayName rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >Adenosine 5'-triphosphate</bp:displayName>
  </bp:SmallMoleculeReference>
  <bp:SmallMolecule rdf:ID="ADP">
    <bp:displayName rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >Adenosine 5'-diphosphate</bp:displayName>
    <bp:standardName rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >ADP</bp:standardName>
    <bp:name rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >adenosine diphosphate</bp:name>
    <bp:dataSource rdf:resource="#KEGG"/>
    <bp:entityReference rdf:resource="#SmallMoleculeReference_10"/>
    <bp:cellularLocation rdf:resource="#cytoplasm"/>
    <bp:dataSource rdf:resource="#aMAZE"/>
    <bp:xref rdf:resource="#KEGG_C00008"/>
    <bp:availability rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    ></bp:availability>
  </bp:SmallMolecule>
  <bp:BiochemicalPathwayStep rdf:ID="BiochemicalPathwayStep_3">
    <bp:stepDirection rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >LEFT-TO-RIGHT</bp:stepDirection>
    <bp:stepConversion rdf:resource="#phosphoglucoisomerase"/>
    <bp:stepProcess>
      <bp:Catalysis rdf:ID="phosphoglucose_isomerase_converts_alpha-D-gluc-6-
p_to_beta-D-fruc-6-p">
        <bp:controller>
          <bp:Protein rdf:ID="phosphoglucose_isomerase">
            <bp:xref rdf:resource="#Swiss-ProtTrEMBL_Q9KH85"/>
            <bp:name rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
            >glucose-6-phosphate isomerase</bp:name>
            <bp:entityReference>
              <bp:ProteinReference rdf:ID="ProteinReference_16">
                <bp:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
                >This example is meant to provide an illustration of how various
BioPAX slots should be filled; it is not intended to provide useful (or even accurate)
biological information    </bp:comment>
                <bp:name rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
                >PHI</bp:name>
                <bp:sequence rdf:datatype="http://www.w3.org/2001/XMLSchema#string"

>KTFSEAIISGEWKGYTGKAITDVVNIGIGGSDLGPYMVTEALRPYKNHLNMHFVSNVDGTHIAEVLKKVNPETTLFLVASKTFTT
QETMTNAHSARDWFLKAAGDEKHVAKHFAALSTNAKAVGEFGIDTANMFEFWDWVGGRYSLWSAIGLSIVLSIGFDNFVELLSGAH
AMDKHFSTTPAEKNLPVLLALIGIWYNNFFGAETEAILPYDQYMHRFAAYFQQGNMESNGKYVDRNGNVVDYQTGPIIWGEPGTNG
QHAFYQLIHQGTKMVPCDFIAPAITHNPLFDHHQKLLSKFFAQTEALAFGKSREVVEQEYRDQGKDPAT</bp:sequence>
                <bp:xref rdf:resource="#Swiss-ProtTrEMBL_Q9KH85"/>
                <bp:standardName
rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
                >PGI</bp:standardName>
                <bp:name rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
                >phosphohexose isomerase</bp:name>
                <bp:displayName rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
                >phosphoglucose isomerase</bp:displayName>
                <bp:name rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
                >glucose-6-phosphate isomerase</bp:name>
                <bp:organism rdf:resource="#Escherichia_coli"/>
                <bp:name rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
                >GPI</bp:name>
              </bp:ProteinReference>
            </bp:entityReference>
            <bp:cellularLocation rdf:resource="#cytoplasm"/>
            <bp:dataSource rdf:resource="#KEGG"/>
            <bp:name rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
            >PHI</bp:name>
            <bp:dataSource rdf:resource="#aMAZE"/>
            <bp:displayName rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
            >phosphoglucose isomerase</bp:displayName>
            <bp:name rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
            >phosphohexose isomerase</bp:name>
            <bp:standardName rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
            >PGI</bp:standardName>
```

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            <bp:name rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
            >GPI</bp:name>
          </bp:Protein>
        </bp:controller>
        <bp:displayName rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
        >catalysis of (beta-D-glu-6-p &lt;=&gt; beta-D-fruc-6-p)</bp:displayName>
        <bp:catalysisDirection rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
        >LEFT-TO-RIGHT</bp:catalysisDirection>
        <bp:controlled rdf:resource="#phosphoglucoisomerase"/>
        <bp:dataSource rdf:resource="#KEGG"/>
        <bp:standardName rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
        >PGI -&gt; (b-d-glu-6-p &lt;=&gt; b-D-fru-6p)</bp:standardName>
        <bp:dataSource rdf:resource="#aMAZE"/>
        <bp:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
        >The source of this data did not store catalyses of reactions as separate
objects, so there are no unification x-refs pointing to the source of these BioPAX
instances.    </bp:comment>
        <bp:availability rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
        ></bp:availability>
        <bp:controlType rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
        >ACTIVATION</bp:controlType>
      </bp:Catalysis>
    </bp:stepProcess>
  </bp:BiochemicalPathwayStep>
  <bp:Stoichiometry rdf:ID="Stoichiometry_37">
    <bp:stoichiometricCoefficient
rdf:datatype="http://www.w3.org/2001/XMLSchema#float"
    >1.0</bp:stoichiometricCoefficient>
    <bp:physicalEntity>
      <bp:SmallMolecule rdf:ID="alpha-D-glucose">
        <bp:xref>
          <bp:UnificationXref rdf:ID="KEGG_C00267">
            <bp:db rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
            >kegg compound</bp:db>
            <bp:id rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
            >C00267</bp:id>
            <bp:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
            >PMID: 9847135 </bp:comment>
          </bp:UnificationXref>
        </bp:xref>
        <bp:displayName rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
        >beta-D-glucose</bp:displayName>
        <bp:dataSource rdf:resource="#aMAZE"/>
        <bp:dataSource rdf:resource="#KEGG"/>
        <bp:cellularLocation rdf:resource="#cytoplasm"/>
        <bp:standardName rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
        >b-D-glu</bp:standardName>
        <bp:name rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
        >&lt;FONT FACE="Symbol"&gt;a&lt;/FONT&gt;-D-glucose </bp:name>
        <bp:entityReference>
          <bp:SmallMoleculeReference rdf:ID="SmallMoleculeReference_12">
            <bp:standardName rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
            >b-D-glu</bp:standardName>
            <bp:structure>
              <bp:ChemicalStructure rdf:ID="ChemicalStructure_5">
                <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
                >alpha-D-glucose</rdfs:comment>
                <bp:structureData
rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
                >C1(C(O)C(O)C(O)C(O1)CO)(O)</bp:structureData>
                <bp:structureFormat
rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
                >SMILES</bp:structureFormat>
              </bp:ChemicalStructure>
            </bp:structure>
            <bp:xref rdf:resource="#KEGG_C00267"/>
            <bp:displayName rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
            >beta-D-glucose</bp:displayName>
            <bp:chemicalFormula rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
            >C6H12O6</bp:chemicalFormula>
            <bp:molecularWeight rdf:datatype="http://www.w3.org/2001/XMLSchema#float"
            >180.16</bp:molecularWeight>
```

```
          </bp:SmallMoleculeReference>
        </bp:entityReference>
      </bp:SmallMolecule>
    </bp:physicalEntity>
  </bp:Stoichiometry>
  <bp:Stoichiometry rdf:ID="Stoichiometry_43">
    <bp:physicalEntity>
      <bp:SmallMolecule rdf:ID="ATP">
        <bp:xref rdf:resource="#KEGG_C00002"/>
        <bp:dataSource rdf:resource="#KEGG"/>
        <bp:dataSource rdf:resource="#aMAZE"/>
        <bp:standardName rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
        >ATP</bp:standardName>
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        >Adenosine 5'-triphosphate</bp:displayName>
        <bp:entityReference rdf:resource="#SmallMoleculeReference_11"/>
        <bp:name rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
        >adenosine triphosphate</bp:name>
        <bp:cellularLocation rdf:resource="#cytoplasm"/>
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    </bp:physicalEntity>
    <bp:stoichiometricCoefficient
rdf:datatype="http://www.w3.org/2001/XMLSchema#float"
    >1.0</bp:stoichiometricCoefficient>
  </bp:Stoichiometry>
  <bp:BiochemicalReaction rdf:ID="glucokinase">
    <bp:xref rdf:resource="#KEGG_R01786"/>
    <bp:name rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >glucose ATP phosphotransferase     </bp:name>
    <bp:displayName rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >beta-D-glu + ATP =&gt; beta-D-glu-6-p + ADP</bp:displayName>
    <bp:dataSource rdf:resource="#KEGG"/>
    <bp:conversionDirection rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >REVERSIBLE</bp:conversionDirection>
    <bp:participantStoichiometry rdf:resource="#Stoichiometry_43"/>
    <bp:participantStoichiometry rdf:resource="#Stoichiometry_37"/>
    <bp:left rdf:resource="#ATP"/>
    <bp:participantStoichiometry rdf:resource="#Stoichiometry_52"/>
    <bp:right rdf:resource="#ADP"/>
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    >2.7.1.1 </bp:eCNumber>
    <bp:left rdf:resource="#alpha-D-glucose"/>
    <bp:dataSource rdf:resource="#aMAZE"/>
    <bp:spontaneous rdf:datatype="http://www.w3.org/2001/XMLSchema#boolean"
    >true</bp:spontaneous>
    <bp:right rdf:resource="#alpha-D-glucose_6-phosphate"/>
    <bp:eCNumber rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >2.7.1.2 </bp:eCNumber>
    <bp:name rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >ATP:D-glucose 6-phosphotransferase </bp:name>
    <bp:participantStoichiometry>
      <bp:Stoichiometry rdf:ID="Stoichiometry_49">
        <bp:stoichiometricCoefficient
rdf:datatype="http://www.w3.org/2001/XMLSchema#float"
        >1.0</bp:stoichiometricCoefficient>
        <bp:physicalEntity rdf:resource="#ADP"/>
      </bp:Stoichiometry>
    </bp:participantStoichiometry>
    <bp:standardName rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >b-D-glu =&gt; b-D-glu-6-p</bp:standardName>
  </bp:BiochemicalReaction>
  <bp:Pathway rdf:ID="Pathway50">
    <bp:name rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >glucose degradation</bp:name>
    <bp:pathwayOrder rdf:resource="#BiochemicalPathwayStep_3"/>
    <bp:standardName rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >glycolysis</bp:standardName>
    <bp:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >This example is meant to provide an illustration of how various BioPAX slots
should be filled; it is not intended to provide useful (or even accurate) biological
information  </bp:comment>
    <bp:displayName rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
```

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    >Glycolysis Pathway</bp:displayName>
    <bp:availability rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >see http://www.amaze.ulb.ac.be/</bp:availability>
    <bp:organism rdf:resource="#Escherichia_coli"/>
    <bp:availability rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >All data within the pathway has the same availability</bp:availability>
    <bp:pathwayComponent rdf:resource="#phosphoglucose_isomerase_converts_alpha-D-
gluc-6-p_to_beta-D-fruc-6-p"/>
    <bp:pathwayComponent>
      <bp:Catalysis rdf:ID="glucokinase_converts_alpha-D-glu_to_alpha-D-glu-6-p">
        <bp:controlType rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
        >ACTIVATION</bp:controlType>
        <bp:displayName rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
        >catalysis of (alpha-D-glu &lt;=&gt; alpha-D-glu-6-p)</bp:displayName>
        <bp:dataSource rdf:resource="#aMAZE"/>
        <bp:dataSource rdf:resource="#KEGG"/>
        <bp:controlled rdf:resource="#glucokinase"/>
        <bp:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
        >The source of this data did not store catalyses of reactions as separate
objects, so there are no unification x-refs pointing to the source of these BioPAX
instances.    </bp:comment>
        <bp:controller rdf:resource="#Protein_54"/>
        <bp:standardName rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
        >GLK -&gt; (a-D-glu &lt;=&gt; a-D-glu-6-p)</bp:standardName>
        <bp:catalysisDirection rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
        >LEFT-TO-RIGHT</bp:catalysisDirection>
      </bp:Catalysis>
    </bp:pathwayComponent>
    <bp:pathwayComponent rdf:resource="#phosphoglucoisomerase"/>
    <bp:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    ></bp:comment>
    <bp:pathwayComponent rdf:resource="#glucokinase"/>
    <bp:name rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >Embden-Meyerhof pathway</bp:name>
    <bp:xref rdf:resource="#PublicationXref49"/>
    <bp:dataSource rdf:resource="#KEGG"/>
    <bp:dataSource rdf:resource="#aMAZE"/>
    <bp:pathwayOrder>
      <bp:BiochemicalPathwayStep rdf:ID="BiochemicalPathwayStep_2">
        <bp:stepConversion rdf:resource="#glucokinase"/>
        <bp:nextStep rdf:resource="#BiochemicalPathwayStep_3"/>
        <bp:stepDirection rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
        >LEFT-TO-RIGHT</bp:stepDirection>
        <bp:stepProcess rdf:resource="#glucokinase_converts_alpha-D-glu_to_alpha-D-
glu-6-p"/>
      </bp:BiochemicalPathwayStep>
    </bp:pathwayOrder>
  </bp:Pathway>
</rdf:RDF>
```

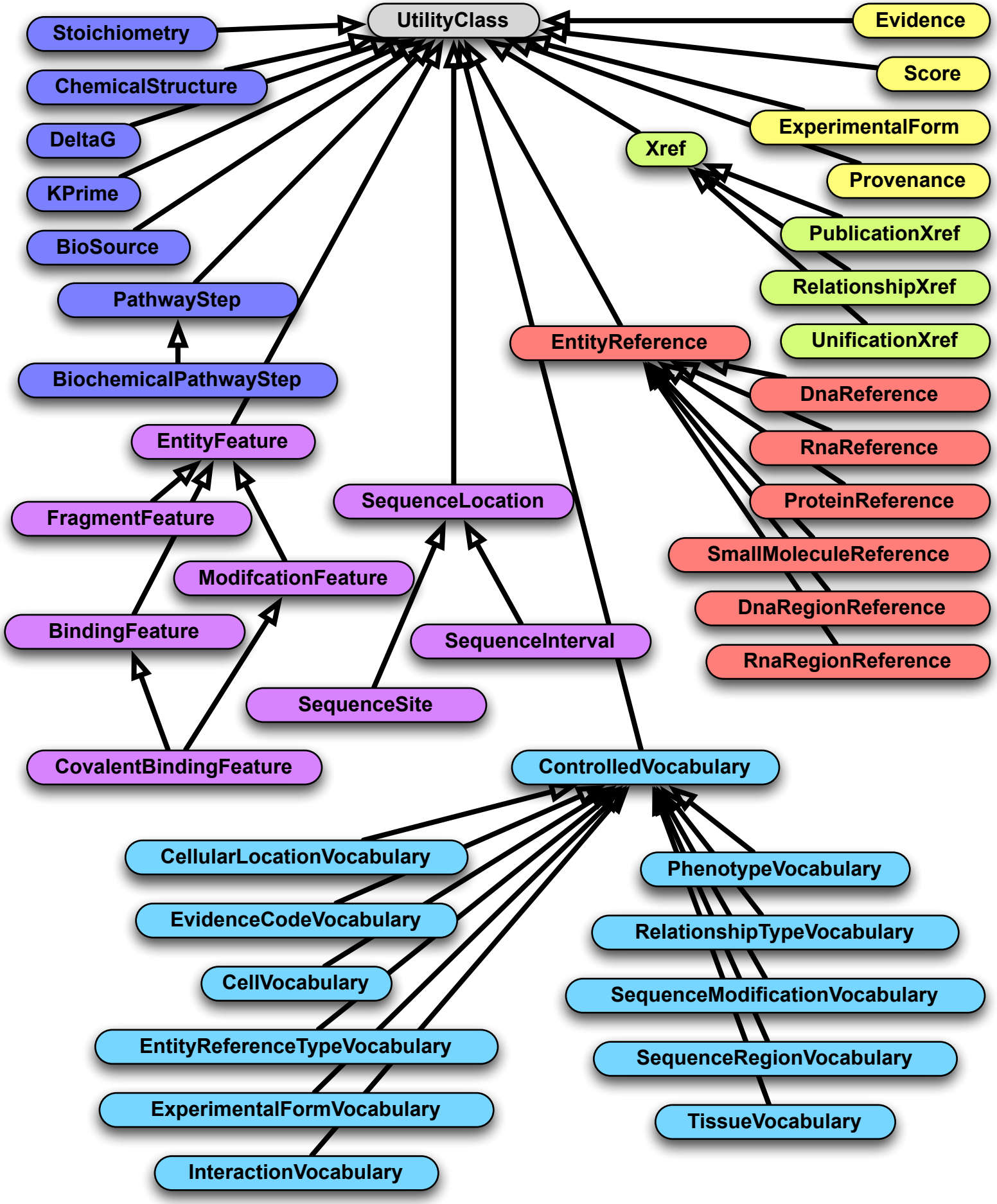

Supplemental Figure S1